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Bioaugmentation Strategies of Ammonia Tolerant Methanogenic Consortia in Continuous Stirred Tank Reactors

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Introduction

Nitrogen is an essential nutrient for the microorganisms during anaerobic digestion, but high ammonia concentrations can inhibit the methane production. Ammonia inhibition is common problem in Danish biogas plants treating animal manures (ammonia rich substrates) leading to decreased process performance (low biogas yields).

Aim: High efficient and innovative bioaugmentation process configuration, which is able to tolerate high ammonia concentrations.

Experimental setup

In this study, three continuous stirred tank reactors (CSTR, Fig. 1) treating cow manure at 37°C were evaluated at high ammonia concentrations. Inoculum was obtained from Hashøj biogas plant.

Figure 1. The CSTR apparatus

Experimental setup

Ammonia will be added step-wise into the reactors with 1g·L^{-1} increment in each step, until process inhibition (Fig. 2).

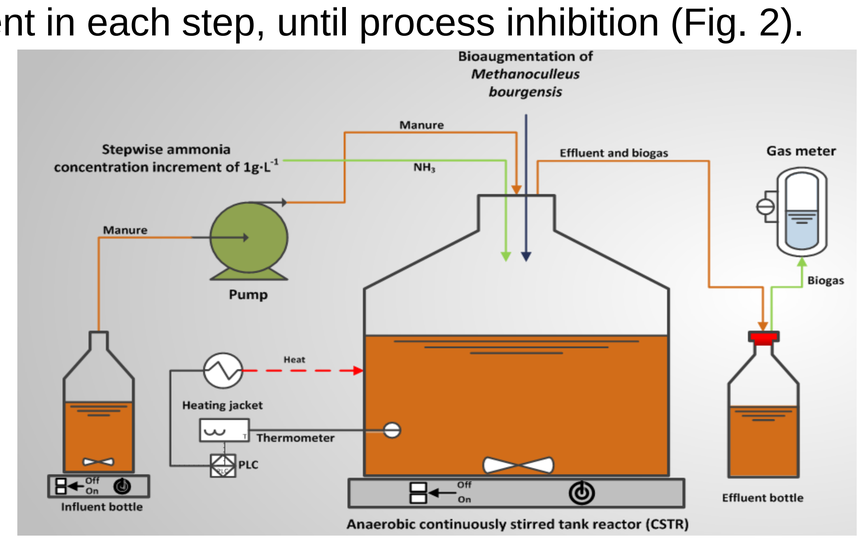

Figure 2. Experimental set-up

Experimental setup

Fluorescence in situ hybridization (FISH) analysis will be used to elucidate the microbial composition of the reactors. In this study, we will apply **innovative bioaugmentation strategies**, introducing an ammonia tolerant hydrogenotrophic methanogen *Methanoculleus bourgensis* (Fig. 3) in mesophilic CSTR reactors.

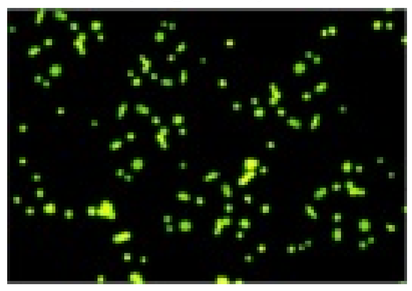

Figure 3. FISH microphotograph of *Methanoculleus bourgensis*

Expected results

The expected results of the current study is the correlation of the relative changes upon changes of reactor operation conditions; i.e. change of dominance of specific species, at the different environmental conditions. Expected outcome from the project is a high efficient and innovative bioaugmentation process configuration, which is able to tolerate high ammonia concentrations.

Conclusions

This study, if successful, will demonstrate that it is possible to use innovative bioaugmentation approach to create a robust anaerobic digestion process under high ammonia concentrations.

Acknowledgments

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